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IN THE DRAWINGS.

    Applicant encloses as an Appendix two replacement drawing sheets which include figures 3 and 4. In the replacement drawing sheets, the reference symbol "FFT" appearing in the originally-filed drawings has been replaced with "DFT". No new matter is included.

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REMARKS

General remarks.

    Claims 1-15 are all the claims pending in the application.

Formal Matters.

The drawing objection.

    The Examiner objected to the drawings as including reference characters not mentioned in the specification. In particular, the Examiner objected to the reference terms "I" and "Q" in Fig. 2.

    Instead of changing the drawings, Applicant herein files a substitute specification that provides the necessary mention of these reference terms. No new matter is included. The Examiner may refer to paragraph [0029] in the substitute specification for the added mention of "I" and "Q."

    Applicant thus respectfully requests the Examiner to withdraw the objection to the drawings.

The objections to the specification.

    The Examiner objected to the specification for a variety of reasons. Applicant turns to each in turn to explain what action Applicant has taken to overcome the objection.

    (a) line numbering: The Examiner objected to the lack of line numbering. Applicant has taken no action to add line numbers. Line numbering is no longer required in the disclosure, and Applicant believes the Examiner has no authority to require line numbering. If the Examiner disagrees, Applicant respectfully invites the Examiner to point out the authority for such a requirement. In accordance with the MPEP, however, Applicant has included in the substitute specification appropriate paragraph numbering. It is respectfully submitted that the paragraph numbering will help overcome the difficulty in referencing specific portions of the disclosure.

    (b) inconsistent terms: The Examiner pointed out an inconsistency between the specification and Figs. 3 and 4, namely, DFT and FFT. Applicant herein amends the drawing

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figures to harmonize them with the specification and respectfully requests the Examiner to withdraw this aspect of the objection. In particular, the term "DFT" has been substituted for the original term "FFT" in Figs. 3 and 4.

(c) equation numbering: The Examiner objected to a lack of numbering of the equations in the disclosure. Applicant has taken no action to add equation numbers. There appears to be no requirement for the numbering of equations either for the understanding of the subject matter of the disclosure, or in the MPEP. It is hoped that the paragraph numbering will answer whatever concerns the Examiner may have had regarding the ability to reference certain parts of the disclosure.

(d-f) informalities: Applicant has corrected this in the substitute specification as follows:

paragraph [0025] - change of IDFT to IFFT

paragraph [0028] - analog to digital / digital to analog

paragraph [0029] - fast Fourier / inverse fast Fourier

(g) request for more information: Applicant draws the Examiner's attention to page 6 of the originally-filed specification, 13th line (in the substitute specification it is paragraph [0027]), where it is stated that:

> Moreover, the OFDM signal so defined can use part of the available carriers, called pilot carriers, to transmit symbols that are known to the receiver, to be able to perform the channel equalization or to restore the symbol or carriers synchronization.

The foregoing paragraph is respectfully submitted in fulfillment of the Examiner's request for information. The foregoing paragraph explains how a local replica of the pilot symbols can be known at the receiving station. The pilot symbol to be used at the receiver end thus is the same one used at the transmitter side.

(h) relationship of I and Q channels: I and Q are the real and imaginary components, respectively, of the OFDM signal. On page 8, line 8 of the originally-filed application (in the substitute specification, paragraph [0036]), "the sequence ... to be transmitted" is identified as $\{X_i,n\}$ meaning that $\{X_i,n\}$ is "I + jQ" (I and Q are shown on the transmission side in Fig. 2).

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Furthermore, page 8, lines 14-15 of the originally-filed specification (paragraph [0038] in the substitute specification), indicates that assuming an ideal channel, the received signal is held to be equal to $\{X_i, n\}$, thus the received signal is the same as the transmitted one.

Additional information on complex numbers and the I+jQ form.

The Examiner may see the I+jQ form used in several sources, although not in the identical context, including (to name but a few):

- *Baseband Simulation of Communication Systems*, April 26, 2000, M. Schiff, PhD., Elanix Application Note 133, http://www.elanix.com/pdf/an133.pdf (see page 2, right-hand column)

- *Satellite Communications: Modem Lectures 1998*, W. G. Cowley, ITR, University of South Australia, http://www.itr.unisa.edu.au/cbt/satcomm/satcomms_notes.html.

- *Introduction to CDMA*, M. Hendry, http://www.bee.net/mhendry/vrml/library/cdma/Chapter1.htm

In the *Introduction to CDMA* work, there is a section entitled "Complex Modulation" in which the following are stated:

> Algebraically, a carrier wave with an applied phase shift, Y(t), can be expressed as a sum of two components, a Cosine wave and a Sine wave, as:
>
> $$A(t)Cos(\omega_c t + \varphi(t)) = I(t)Cos(\omega_c t) + Q(t)Sin(\omega_c t)$$
>
> I(t) is called the real, or In-phase, component of the data, and Q(t) is called the imaginary, or Quadrature-phase, component of the data. We end up with two Binary PSK waves superimposed. These are easier to modulate and later demodulate.
>
> This is not only an algebraic identity, but also forms the basis for the actual modulation/demodulation scheme. The

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transmitter generates two carrier waves of the same frequency, a sine and cosine. I(t) and Q(t) are binary, modulating each component by phase shifting it either 0 or 180 degrees. Both components are then summed together. Since I(t) and Q(t) are binary, we'll refer to them as simply I and Q.

The receiver generates the two reference waves, and demodulates each component. It is easier to detect 180_ phase shifts than 90_ phase shifts. The following table summarizes this modulation scheme. Note that I and Q are normalized to 1.

Symbol	I	Q	Phase shift
00	+1	+1	45°
01	+1	-1	315°
10	-1	+1	135°
11	-1	-1	225°

For Digital Signal Processing, the two-bit symbols are considered to be complex numbers, $I + jQ$.

The foregoing information is presented only for the purpose of demonstrating to the Examiner that the I and Q channels are well known and understood in the relevant art, and that further information (if needed) would be easy to glean from available articles and/or textbooks.

If the Office requires further information on the relationship of the I and the Q channels, Applicant is available to provide whatever assistance is necessary.

Prior art rejections.

Schmidl in view of Lee.

Claims 1-5, 7-13 and 15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Schmidl et al. (U.S. Patent No. 5,732,113) in view of Lee (U.S. Patent No. 6,373,861 B1). In making this rejection, the Examiner acknowledged that Schmidl lacks the required feed forward loop but asserted that the teachings of Lee compensate for the Schmidl deficiencies.

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Applicant respectfully traverses this rejection. Applicant agrees that Schmidl lacks the required feed forward loop, but disagrees about the Lee teachings. In particular, Lee teaches only a feed back loop.

In Fig. 4 of Lee, the flow of the loop is clearly in the feed back direction: 155, 157, 147, 149, 151, 143. In Fig. 5 of Lee, the same direction is seen: 162, 166, 167, 168, 169, 161 or 162, 166, 170, 171, 172, 161. The control signals from controller 195 are not part of a feed back or feed forward loop; they are just control signals.

Since Lee teaches or suggests only a feed back loop, it cannot reasonably be said to be a reference that would have led the artisan of ordinary skill to have modified Schmidl to include the following feature of independent claim 1:

> performing a feed-forward correction of
> phase error by utilizing such extracted
> pilot subcarriers, said feed-forward
> correction step being carried out before
> performing said discrete Fourier transform.

Since neither Schmidl, nor Lee, nor their combined teachings taken for what they would have meant as a whole to an artisan of ordinary skill, teach or suggest the foregoing requirement of independent claim 1, Applicant respectfully submits that Schmidl and Lee do not render independent claim 1 unpatentable within the meaning of 35 U.S.C. § 103. Applicant therefore respectfully requests the Examiner to withdraw this rejection of independent claim 1, and its dependent claims.

Independent claim 9 patentably distinguishes over the combined teachings of Schmidl and Lee for similar reasons, in view of its requirement for:

> means for performing, by utilizing such
> extracted pilot subcarriers, a feed-forward
> correction of phase error to be carried out
> before performing said discrete Fourier
> transform.

For such similar reasons, Applicant respectfully requests the Examiner to withdraw this rejection of independent claim 9, and its dependent claims.

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Schmidl in view of Lee and Wesel.

Claims 8 and 15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over

Schmidl et al. (U.S. Patent No. 5,732,113) and Lee (U.S. Patent No. 6,373,861 B1) as applied to

claims 1-7 above, and further in view of Wesel et al. (U.S. Patent No. 6,125,150). Claim 8

depends from independent claim 1, and claim 15 depends from independent claim 9.

Applicant has already pointed out, above, that the combined teachings of Schmidl and

Lee do not meet the above-identified requirements of independent claims 1 or 9. Applicant finds

in Wesel no teaching or suggestion that would have compensated for the already identified

deficiencies of the Schmidl / Lee combination. Even taken for what they would have meant as a

whole to an artisan of ordinary skill, the combined teachings of these three references would not

have (and could not have) led the person of ordinary skill to the subject matter of either

independent claims 1 or 9, much less their dependent claims 8 and 15.

For these reasons, therefore, Applicant respectfully requests the Examiner to withdraw

this rejection of dependent claims 8 and 15.

Allowable Subject Matter

Claims 6 and 14 are objected to as being dependent upon a rejected base claim, but the

Examiner indicated they would be allowed if rewritten in independent form including all of the

limitations of the base claim and any intervening claims. In view of the foregoing remarks with

respect to independent claims 1 and 9, however, Applicant respectfully submits that the claims

are allowable in their present form. Applicant thus respectfully requests the Examiner to allow

claims 6 and 14 in their present form.

Conclusion and request for telephone interview.

In view of the above, reconsideration and allowance of this application are now believed

to be in order, and such actions are hereby solicited. If any points remain in issue which the

Examiner feels may be best resolved through a personal or telephone interview, the Examiner is

kindly requested to contact the undersigned at the telephone number listed below.

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The USPTO is directed and authorized to charge all required fees, except for the Issue

Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any

overpayments to said Deposit Account.

Respectfully submitted,

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